AQUATIC HETEROPTERA OF THE LAKE MANGUAO CATCHMENT, PALAWAN AND NEW RANK OF *Rhagovelia kawakamii hoberlandti* HUNGERFORD & MATSUDA 1961

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ABSTRACT

Results of an inventory of the fauna of aquatic and semiaquatic true bugs (Insecta: Hemiptera) of small streams in a lake catchment of northern Palawan are presented. Twenty-one species were recorded. Taxonomic and ecological notes, distribution and collection sites are given for each identified taxon. *Rhagovelia hoberlandti* Hungerford & Matsuda 1961 is newly ranked as a subspecies of *R. kawakamii* (Matsumura 1913): *Rhagovelia kawakamii hoberlandti* Hungerford & Matsuda 1961, stat.n. *Cercotmetus asiaticus* Amyot & Serville 1843 is recorded for the first time from the Philippines. Endemic and few undescribed taxa are discussed. Additional environmental data of the sampled waters are discussed with comparative surveys in the country.

KEYWORDS**:** *Philippines, AQUA Palawana, freshwater biodiversity, taxonomy, water bugs, Hemiptera*

INTRODUCTION

Lake Manguao (Fig. 2), locally also known as Lake Danao, is the only real natural freshwater lake on the Philippine island of Palawan. The lake was

created by volcanic activity (Davies & Green 1990). The sampled streams are tributaries of its catchment that covers about 4,500 ha (Sariego *et al.* 2003) of residual forest, secondary forest and farmland (mainly slash-and-burn agriculture).

A project of the AQUA Palawana program has surveyed the aquatic macroinvertebrates of the Lake Manguao catchment in 2007 and 2008. Some results, including the description of new species of true freshwater crabs (Crustacea: Decapoda: Gecarcinucidae: *Parathelphusa*, Potamidae: *Insulamon*) and minute moss beetles (Insecta: Coleoptera: Hydraenidae: *Hydraena*) have been published previously (Freitag & Yeo 2004, Freitag & Jäch 2007, Freitag 2012). A second part of the taxonomic-faunistic work in hand focusing on aquatic Coleoptera is presently under review (Freitag & Zettel, submitted). A comparable faunistic study on Philippine aquatic Coleoptera and Hemiptera (Freitag & Pangantihon 2010) was recently published for the Lake Naujan catchment in Mindoro, which included several lake habitats.

Hemiptera, the insect order focused herein, display an enormous range of strategies to adapt to their environment as probably no other insect orders. This group has conquered almost all kinds of habitats, and thus, occur at a high diversity in aquatic and semiaquatic environments.

The large majority of Philippine Gerromorpha and Nepomorpha taxa are known to science due to a higher number of taxonomic studies on aquatic bugs compared to other groups of insects. Comprehensive taxonomic studies on these infraorders have been published within the scope of the Philippine Water Bug Inventory Project by the Museum of Natural History University of the Philippines Los Baños, the Department of Entomology University of the Philippines Los Baños and the Natural History Museum Vienna (Gapud & Zettel 1999, Zettel & Gapud 2003) in the last two decades.

The current study is the first comprehensive regional survey on aquatic Heteroptera from the island of Palawan. It is another step towards a better understanding of Palawan's freshwater ecosystems and biodiversity, aimed to enable future monitoring activities.

MATERIAL AND METHODS

Abbreviations and Acronyms

asl above sea level (elevation)
c. circa

CPOM	Coarse Particulate Organic Matter
E	emergence trap collection
ex(s)	exemplar(s)
N	nymph
NN	nymphs
M	manual collection
s.str.	*sensu stricto* (in the strict sense)

Field Sampling. Fifteen streams and their different microhabitats were sampled for aquatic and semi-aquatic Heteroptera (Fig. 1). Specimens were collected by the use of hand nets and vouchers of each morphotaxon from one microhabitat site were preserved in 96% alcohol. The samples were labeled with the collector's name and the collection date plus detailed data for the respective (sub-)site including a site code as referred to in the taxonomic "Material" listings:

(11a)M	Alipuran Stream, littoral gravel & sand, secondary vegetation, c. 50 m asl, 10°44'59"N119°30'43"E
(11b)M	Alipuran Stream, residual pools, leaf litter, secondary vegetation, c. 50 m asl, 10°45'02"N 119°30'44"E
(11c)M, E	Alipuran Stream, riffles, gravel, boulders, secondary vegetation, c. 45 m asl, 10°45'04"N119°31'06"E
(13a)M	Manguao Stream, half way to Highway, c. 30 m asl, 10°46'13"N 119°30'52"E
(13b)M	Manguao Stream, 1/3 to Highway, disturbed primary forest, c. 35 m asl, 10°47'N 119°30'E
(63a)M, E	Southern Manguao Stream tributary, disturbed primary forest, pools, run, c. 30 m asl, 10°46'00"N 119°30'43"E (Fig. 5)
(63b)M, E	Southern Manguao Stream tributary, disturbed primary forest, riffles/ runs c. 35 m asl, 10°45'53"N 119° 30'42"E
(64a)M	Tubog Creek, "Malaipit Campsite", reforestation area, riffles/ runs / pools, c. 80 m asl, 10°48'52"N 119°30'40"E
(64b)M	Tubog Creek, "Malaipit Campsite", reforestation area, residual pools, c. 80 m asl, 10°48'52"N 119°30'40"E
(67)M	Tutong Creek, beside Taytay trail, secondary forest, c. 25 m 10°47'12"N 119°31'40"E

(68)M	Small West coast tributary, secondary forest, riffles, falls, pools, c. 20 m asl, 10°45'57"N 119°31'29"E
(71a)M	Malibongbong Creek headwater, secondary forest, residual pools, leaf litter, sand, c. 20 m asl, 10°44'27"N 119°31'15"E
(71b)M, E	Malibongbong Creek, secondary forest, pools, leaf litter, sand, CPOM, Cryptocorinae,c. 20 m asl, 10°44'34"N 119°31'22"E
(72a)M, E	Malibongbong helocrene, secondary forest, leaf litter, CPOM, sand, c. 25 m asl, 10°44'29"N 119°31'25"E (Fig. 6)
(73a)M, E	Eastern Sinangalit Creek, gravel, boulders, CPOM, c. 20 m asl, c. 10°46'58"N 119°31'25"E (Fig. 4)
(73b)M, E	Western Sinangalit Creek, rocks pools/ run, leaf litter, c. 20 m asl, 10°46'46"N 119°31'05"E
(74a)M	Pahok Creek, residual pools, rocks, leaf litter, secondary vegetation, c.100 m asl, 10°46'56"N 119°32'01"E
(74b)M, E	Pahok Creek, riffles/ runs/ pools, gravel, sand CPOM, secondary forest, c. 25 m asl, 10°46'42"N 119°31'55"E
(78a)M, E	Culanga Stream, Reyes Farm, rocks, leaves, secondary vegetation, c.10 m asl, 10°47'48"N 119°30'46"E
(78c)M	Culanga Stream Spring, loam, CPOM, leaf litter, secondary vegetation, c. 90 m asl, 10°47'24"N 119°31'47"E
(100)M	Small hill creek c. 4 km southeast of town proper; rocks, sand, leaves, degraded forest, c. 15 m asl, 10°48'05"N 119°33'02E
(101)M	Shallow mountain creek beside highway, rocks, sand, CPOM, secondary forest, c. 80 m asl, 10°44'56"N 119°30'20"E
(119)M	Mechico Creek, riffles/ runs/ pools, boulder, gravel, sand, CPOM, degraded primary forest, c. 20 m asl, 10°46'37"N 119°33'14"E
(120)M, E	Malarad Creek, riffles/ runs/ pools, rocks, gravel, sand, CPOM, degraded primary forest, c. 20 m asl, 10°46'22"N 119°33'36"E
(121a)M, E	Eastern Enolbong Creek, riffles/ runs, rocks, gravel, CPOM, degraded primary forest, c. 20 m asl, 10°47'07"N 119°33'02"E (Fig. 3)
(121b)M	Western Enolbong Spring, riffles/ pools, rocks, gravel, sand, CPOM, primary forest, c. 20 m asl, 10°46'40"N 119°32'19"E

(122)M Mountain creek, rocks, gravel, CPOM, riffles/ small falls, degraded primary forest, 10°44'57"N 119°30' 09"E

(146)M Mecadlum Creek, rocks, boulder, gravel, CPOM, degraded primary forest, c. 30 m asl, 10°45'45"N 119°34'00"E

Except for the Manguao Stream (sites 13, 63), all lake tributaries sampled are temporary inflows that might dry up during times of low rainfall (pers. obs., Davies & Green 1990), although Alipuran Stream (11) and Malarad Creek (120), in particular, usually withstand the dry season.

Conductivity, pH, water temperature, and dissolved oxygen of some tributary waters were measured twice in August and September 2007 by using electronic meters. These environmental data are discussed in a separate paper (Freitag & Zettel, submitted).

Handling of Collections. Reference specimens of all species are deposited in University of the Philippines Los Baños, Museum of Natural History, Entomological Collection, Philippines. Duplicates, if available, are given to the following scientific collections: Palawan Council for Sustainable Development, Philippines; University of San Carlos, Cebu, Philippines; Natural History Museum Vienna, Austria; Senckenberg Museum of Zoology Dresden, Germany); H. Freitag, Palawan Private Collection. Material that requires further study is kept in the latter collection for the meantime until further designation. Photographs of Hemiptera specimens were obtained from the NMW Hemiptera Image Collection and are published herein with permission.

RESULTS

Taxonomic inventory. Twenty-one species taxa belonging to nine families of Heteroptera were recorded. They are listed in Table 1. Detailed taxonomic accounts are provided in the subsequent chapter.

FAUNISTICS, TAXONOMY AND ECOLOGY

HEMIPTERA
GERRIDAE (Water Striders)

Limnogonus (s.str.) *fossarum fossarum* (Fabricius 1775)

Cimex fossarum Fabricius 1775: 727.
Limnogonus fossarum (Fabricius 1775): Andersen 1975: 30-36.

Material. 1 ex. (11c 22.8.2007 M).

Distribution. The typical subspecies is distributed from India to Japan, the Philippines, Borneo, and Sumatra; other subspecies occur further eastwards to Australia and Vanuatu (Andersen 1975, 1995; Damgaard *et al.* 2010).

Ecology. This is a common and frequently collected species that inhabits various kinds of stagnant freshwater, including temporary water bodies like paddy fields.

Remarks. Three more species of the genus (*Limnogonus anderseni* Zettel 2004, *L. hungerfordi* Andersen ,1975 *L nititus* (Mayr 1965) are known from the country (Zettel 2004).

***Limnometra ciliata* Mayr 1865**

Limnometra ciliata Mayr 1865: 444 (orig. descr.); Zettel & Chen 2000: 77.

Material. 1 female (71b 07.5.2008 M).

Distribution. This species is widely distributed from Thailand and Vietnam eastwards to the Solomon Islands, the Fiji Islands, and Guam (Andersen 1995).

Ecology. Typical habitats of *Limnometra ciliata* are the edges of large, shallow stagnant waters. The species is only found in rivers, when the water current is very low and large lentic areas are available (Zettel & Chen 2000).

Remarks. Six species of *Limnometra* are recorded from the Philippines, three species from the Palawan Region (Zettel & Chen 2000, Zettel *et al.* 2009).

***Limnometra palawanensis* Zettel & Chen 2000**

Limnometra palawanensis Zettel & Chen 2000: 81-83 (orig. descr.).

Material. 1 female, 2 NN (63a 14.9.2007 M); 1 male, 1 female (68 22.4.2007 M); 2 NN (71a 07.5.2007 M); 1 male, 1 N (71b 07.5.2008 M); 1 male (72a 28.8.2008 M); 1 male, 1 N (73a 3.11.2008 M); 1 male, 1 female, 2 NN (74b 14.9.2008 M); 1 ex. (78a 12.6.2007 E); 1 female (101 22.8.2007 M); 1 female (119 04.11.2007 M); 2 females, 1 N (119 28.9.2008 M); 1 female (120 04.11.2007 M); 2 NN (121a 20.11.2007 E); 1 female, 1 N (121a 29.8.2008 M); 1 female (121b 05.11.2008 M); 1 female, 1 N (146 29.8.2008 M).

Distribution. *Limnometra palawanensis* is endemic to the Palawan Region (Zettel & Chen 2000).

Ecology. This species is usually found in small stagnant freshwaters in the vicinity of streams and rivers, or in quiet bays of streams (e.g., Figs. 3, 5, 6). Most specimens collected are micropterous and flightless.

Remarks. *Limnometra palawanensis* is an allopatric sister species of *L. nigripennis* Mayr 1865, a species commonly inhabiting other Philippine islands (Zettel & Chen 2000).

Neogerris cf. *parvulus* (Stål 1860)

Gerris parvula Stål 1860: 265 (orig. descr.).
Neogerris parvula: Andersen 1975: 69 (partim).
Neogerris parvulus: Andersen 1995, Zettel 2004: 369-370; Chen *et al.* 2005.

Material. 2 NN (101 22.8.2007 M).

Distribution. According to Andersen (1975, 1995) *Neogerris parvulus* has a wide distribution from the Middle East to China and further eastwards through the entire Oriental and Malesian Regions to the Solomon Islands. However, as pointed out by Zettel (2004) who separated *N. philippinensis* Zettel, 2004 from *N. parvulus*, some of the eastern populations may belong to further, still undescribed cryptic species.

Ecology. *Neogerris* species inhabit stagnant freshwaters including paddy fields and very slowly running waters like irrigation channels.

Remarks. Due to the nymphal stage of the material a secured identification is impossible. However, *Neogerris parvulus* is the only species known from the Palawan region (Zettel 2004), although the occurrence of further species cannot be ruled out (e.g., *N. assimilis* Andersen 1975 which is common in the lowlands of Borneo).

Esakia palawanensis Zettel 2004

Esakia palawanensis Zettel 2004: 379-382 (orig. descr.).

Material. 6 exs. (11c 22.8.2007 M); 2 males (119 28.9.2008 M).

Distribution. This species is endemic to the Palawan region and recorded from the islands of Palawan and Busuanga (Zettel 2004).

Ecology. *Esakia palawanensis* inhabits slowly or moderately fast flowing sections of streams and tolerates low salinity in estuaries (Zettel 2004).

Metrocoris tenuicornis Esaki 1926

Metrocoris tenuicornis Esaki 1926: 125-126 (orig. descr.); Chen & Nieser 1993; Polhemus 1998.

Material. 2 males, 1 females (63a 14.9.2007 M); 1 N (63a 16.4.2007 M); 1 male, 2 females, (68 22.4.2007 M); 2 N (72a 28.8.2008 M); 1 male, 1 female (73a 3.11.2008 M); 1 male, 1 N (74b 14.9.2008 M); 1 N (78a 12.6.2007 M); 2 females (100 21.8.2007 M); 1 female (101 22.8.2007 M); 3 females (119 28.9.2008 M); 1 female, 1 N (120 04.11.2007 M); 3 female, 1 N (146 29.8.2008 M).

Distribution. *Metrocoris tenuicornis* is widely distributed from western India and southern China through the whole southeastern Asian mainland to Sumatra, Java, Borneo, and the Philippines (Chen & Nieser 1993), where the species is restricted to the Palawan region (Chen & Nieser 1993) and Mindoro (Polhemus 1998).

Ecology. Species of *Metrocoris* usually inhabit streams in uplands, but *M. tenuicornis* is an exception by preferring various kinds of running water in lowlands. It was common in many of the streams sampled (e.g. Figs. 4, 5, 6).

Remarks. Of the four *Metrocoris* species presently known from the Philippines, *M. tenuicornis* is the only one occurring in the Palawan region.

Rheumatogonus vantoli Chen & Nieser 2002

Rheumatogonus borneensis: Andersen 1967 (misidentification), Zettel 1994a (misidentification).
Rheumatogonus vantoli Chen & Nieser 2002: 393-395 (orig. descr.).

Material. 2 males, 1 female (71b 07.5.2007 M); 2 N (72a 28.8.2008 M); 1 female, 2 N (73a 3.11.2008 M); 1 male, 4 females, 1 N (78a 12.6.2007 M).

Distribution. This species has been described from Sabah (Chen & Nieser 2002) and has been collected from many parts of Borneo (Natural History Museum Vienna and Zoological Reference Collection Singapore, unpublished data). Outside of Borneo, it occurs only in the Palawan region.

Ecology. Like all Ptilomerinae, *R. vantoli* inhabits running waters, but this species has a notably wide tolerance to various kinds of streams and rivers and a preference for shaded sections, such as the habitats in Figures 4 and 5. *Rheumatogonus* species have often been observed to form large schools consisting of several dozens of specimens. Winged specimens are rare.

Remarks. Prior to the study by Chen & Nieser (2002), who re-examined the type of *R. borneensis* Esaki 1927, material from Palawan was wrongly published under that name (Andersen 1967, Zettel 1994a). For this reason, the first record of *R. vantoli* from the Philippines happened in the list by Chen *et al.* (2005).

HEBRIDAE (Velvet Water Bugs)

Hebrus sp.

Material. 5 exs. (71b 07.5.2007 M).

Ecology. *Hebrus* species live on the terrestrial water edge and run occasionally onto the water surface. Some species live in hygropetric places or on mossy rocks.

Remarks. The taxonomy of the specious genus *Hebrus* still needs to be revised.

HYDROMETRIDAE (Marsh Treaders)

Hydrometra mindorensis Polhemus 1976

Hydrometra mindorensis Polhemus 1976 (in Polhemus & Reisen 1976): 283-284 (orig. descr.); Polhemus & Polhemus 1995: 36; Polhemus & Lansbury 1997: 21; Gapud *et al.* 2003: 144 (key), 153-155, and references therein.

Material. 1 female (61a 14.9.2007 M); 1 male, 1 female (68 22.4.2007 M); 2 females, 2 NN (72a 07.5.2008 M); 1 male (73b 28.9.2007 M); 1 male, 1 female (119 28.9.2008 M); 1 N (121a 20.11.2007 E).

Distribution. This species is known from China, Borneo, the Philippines, Sulawesi, Ambon and New Guinea, but does not occur in the Sundaic region except for northern Borneo (Polhemus & Polhemus 1995, Polhemus & Lansbury 1997, Yang & Zettel 2005). It has been recorded from all over the Philippine Islands (Gapud *et al.* 2003).

Ecology. *Hydrometra* spp. live in the transition zone between water and land. *Hydrometra mindorensis* is often found in the vicinity of running waters. It was found inhabiting the stagnant part of the lake, side pools near the river and most abundantly the helocrene (=helokrene, a marsh spring community) (Fig. 6).

Remarks. Four species of *Hydrometra* are known from the Philippines (Gapud *et al.* 2003), namely *H. julieni* Hungerford & Evans 1934, *H. lineata* Eschscholtz 1822, *H. mindoroensis*, and *H. orientalis* Lundblad 1933.

MESOVELIIDAE (Water Treaders)

Mesovelia horvathi Lundblad 1933

Mesovelia horvathi Lundblad 1933: 190-192 (orig. descr.); Polhemus & Polhemus 2000, and references therein.

Material. 1 female (63a 14.9.2007 M); 1 male (72a 28.8.2008 M); 1 female, (74b 14.9.2008 M); 1 N (146 29.8.2008 M).

Distribution. This species is very widespread and common in the Australasian Region (Polhemus & Polhemus 2000).

Ecology. *Mesovelia horvathi* mostly inhabits stagnant waters on the edge of streams, rivers, lakes, and rice fields.

Remarks. Two more species of this genus are reported from the Philippines: *Mesovelia vittigera* Horváth 1895 and *M. ujhelyii* Lundblad 1933 (Gapud 1986), but the conspecific identity of the latter needs to be clarified.

VELIIDAE (Riffle Bugs)

Microvelia (*Picaultia*) *douglasi* Scott 1874

Microvelia douglasi Scott 1874: 448-449 (orig. descr.); Andersen *et al*. 2002: 242, 245, 247; Freitag & Pangantihon 2010: 155.

Microvelia (*Picaultia*) *douglasi* Scott 1874: Zettel 2012: 106.

Material. 1 female (64a 19.11.2007 M).

Distribution. *Microvelia douglasi* has a wide distribution in the Oriental, Australian and Melanesian regions eastwards up to the remote islands of the West Pacific.

Ecology. This species is very common throughout its wide range. It inhabits all kinds of stagnant freshwaters including paddy fields, puddles and small artificial water bodies. The species is often attracted to light. The single specimen was found in a side pool of Tubog Creek which was rich in CPOM, situated in a reforestation site near the town of Taytay.

Remarks. *Microvelia douglasi atrolineata* Bergroth 1918 was described from the Philippines and can be primarily separated by the male genitalia (see Yano *et al*. 1981). However, the consistency of differential characters needs verification (see Andersen 1967).

Microvelia (*Dilutovelia*) *leveillei leveillei* (Lethierry 1877)

Hydroessa leveillei Lethierry 1877: 101 (orig. descr.).
Microvelia diluta Distant 1909; Lundblad 1933; Miyamoto 1953.
Microvelia leveillei: Zettel & Gapud 1999: 136.
Microvelia (*Dilutovelia*) *leveillei leveillei* (Lethierry, 1877): Zettel 2012: 106.

Material. 1 female (63a 16.4.2007 M).

Distribution. *Microvelia leveillei leveillei* has a wide distribution from India to the southern parts of China, to the Philippines and the Lesser Sunda islands.

Remarks. The conspecificity of the sister subspecies *M. leveillei nioumbadjoui* Poisson 1959 from the Comores needs confirmation.

Ecology. This species inhabits fish-free, open, stagnant water bodies. A typical habitat in the Philippines are ponds for bathing water buffaloes on meadows, where *M. leveillei* can be found in enormous numbers forming dark "clouds" on the water surface.

Remarks. Lundblad (1933) revised this species and Miyamoto (1953) gave an interesting account on its biology, both under the junior synonym *M. diluta*. This synonymy was established by Zettel & Gapud (1999). Zettel (2012) erected the monotypic subgenus *Dilutovelia* for this species.

Microvelia spp.

Material. 1 female (11a 16.12.2007 M); 2 males, 1 female (63a 14.9.2007 M); 3 females (78a 02.6.2007 E); 1 male, 2 females (71a, 07.5.2007 M).

Remarks. This material probably comprises several species of which at least the specimens from site 71a are new to science. As the genus needs to be revised, we refrain from an attempt at description of the new species at this time.

Rhagovelia kawakamii hoberlandti Hungerford & Matsuda 1961, stat.n.

Rhagovelia (*Rhagovelia*) *hoberlandti* Hungerford & Matsuda 1961: 260-261 (orig. descr.).
Rhagovelia kawakamii (Matsumura 1913) (partim): Polhemus & Polhemus 1988: 206 (*R. hoberlandti* a synonym of *R. kawakamii*).
Rhagovelia kawakamii forma *hoberlandti*: Zettel 1996: 127-129.
Rhagovelia hoberlandti: Chen *et al.* 2005: 438.

Material. 1 male, 2 females (63a 14.9.2007 M); 3 males, 5 females, 1 N (68 22.4.2007 M); 1 male, 4 females (72a 28.8.2008 M); 4 male, 3 female, 2 NN (73a 3.11.2008 M); 1 male, 1 female (74b 14.9.2008 M); 3 females (101 22.8.2007 M); 1 male, 2 females (119 04.11.2007 M); 2 males, 1 female, 1 female (119 28.9.2008 M); 1 ex. (120 04.11.2007 M); 1 male, 2 females (122 06.11.2007 M); 5 males, 3 female, (146 29.8.2008 M).

Distribution. See Remarks.

Ecology. As typical for the genus, *Rhagovelia kawakamii hoberlandti* is commonly found in run and riffle section of streams (e.g. Figs. 4, 5), but it was surprisingly abundant in the helocrene as well (Fig. 6).

Remarks. *Rhagovelia kawakamii* was described from Botel Tobago [= Kotosho Island], a small island southeast of Taiwan; the typical form was later also recorded from Luzon, Philippines (Polhemus & Reisen 1976; Zettel 1996), where it is common in the island's northern part, but absent in the south. *Rhagovelia hoberlandti* was described from Busuanga Island. The two taxa were synonymized by Polhemus & Polhemus (1988) who recorded *R. kawakamii* also from northern Sabah, Borneo. However, *Rhagovelia kawakamii* does not occur on Mindoro (between Busuanga and Luzon), where a related, but very distinct species, *R. mindoroensis* Zettel 1994 occurs (see Zettel 1994b, 1996). Zettel (1996) treated *"hoberlandti"* as a weakly distinct form from Busuanga, Palawan, Balabac, and northern Borneo, which is mainly distinguished from the typical form by average colour and size, width and pilosity of tergites and laterotergites of apterous females, and the size and arrangement of teeth on the metatibia of large apterous males (see Zettel 1996: Figs. 49, 51). Zettel (1996: Figs. 43, 44) also described minute differences in the parameres. Without comments, Chen *et al.* (2005) resurrected *R. hoberlandti* as a valid species. Under the described premises, namely the interrupted distribution but only weak morphological distinction, we regard *kawakamii* and *hoberlandti* as two isolated subspecies of the same species.

***Rhagovelia* cf. *palawanensis* Zettel 1994**

Rhagovelia palawanensis Zettel 1994b (orig. descr.):40-44.

Material. 3 exs. (11c 22.8.2007 M); 1 male, 2 females (63a 14.9.2007 M); 1 female (63b 21.4.2007 M); 2 males (78a 12.6.2007 M); 1 females (122 06.11.2007 M).

Distribution. *Rhagovelia palawanensis* is endemic to Palawan Island.

Ecology. This species is found in swarms skating the water surface of run and riffle section of streams such as in Fig. 5.

Remarks. The type locality of *R. palawanensis* is at the Estrella Falls near Narra, southern Palawan. Unpublished taxonomic studies revealed that populations from the north of Palawan, including the material from the Manguao catchment differs from typical populations from the island's southern and central parts by colour and minor structural details and probably represent a cryptic species or at least a subspecies which will be described in a forthcoming study.

***Strongylovelia palawanensis* Lansbury & Zettel 1997**

Strongylovelia palawanensis Lansbury & Zettel 1997: 62 (orig. descr.); Zettel 2003: 191.

Material. 2 males, 1 N (11b 22.4.2007 M); 1 ex. (11c 22.8.2007 M); 1 female (63b 21.4.2007 M).

Distribution. Described from Palawan and Busuanga, *S. palawanensis* is presently considered endemic in the Greater Palawan region.

Ecology. Typical habitats of *Strongylovelia* species are shaded bays of streams or large side pools. Some species are tolerant to light salinity in estuaries.

Remarks. Zettel (2003) treated eight species and two subspecies in the Philippines, *S. palawanensis* being the only species known from the Palawan region.

OCHTERIDAE (Velvety Shore Bugs)

***Ochterus* sp.**

Material. 1 N (11c 22.8.2007 M).

Ecology. The single exemplar was found at the river side of riffle sections of the Alipuran stream.

Remarks. Due to the immature stage of the specimens collected it is not possible for it to be identified to species. Ten *Ochterus* species are known from the Philippines, of which nine are endemic to the country (Gapud 2003).

NOTONECTIDAE (Backswimmers)

Anisops kuroiwae Matsumura 1915

Anisops kuroiwae Matsumura 1915: 109 (orig. descr.); Zettel *et al.*, 2012: 31, and references therein.

Material. 2 males, 2 females (64a 19.11.2007 M).

Distribution. *Anisops kuroiwae* is a common and widely distributed backswimmer. Its large distribution area spans from India through southeastern Asia to Hainan, Taiwan, Iriomote, and the Philippines from where numerous records exist (e.g., Yano *et al.* 1981; Nieser & Chen 1999; Zettel 2003; Chen *et al.* 2005; Zettel *et al.* 2012).

Ecology. Anisopinae live in stagnant waters including pools of streams where they float in the open water. They possess haemoglobin cells for oxygen storage and a small gas store to keep buoyancy, unlike the surface-inhabiting Notonectinae (Chen *et al.* 2005 and references cited therein).

Remarks. *Anisops* species are good flyers and are frequently attracted by light. Their good dispersal abilities are responsible for the wide distribution that is characteristic of many species.

Enithares quadrispinosa Lansbury 1967

Enithares freyi quadrispinosus Lansbury 1967: 94 (orig. descr.); Lansbury 1968: 436; Chen *et al.* 2005: 422.
Enithares quadrispinosa: Zettel *et al.*, 2012: 39-41, and references therein.

Material. 1 male, 1 female (13b 29.4.1995M), 2 males, 1 female (63a 14.9.2007 M); 2 males (72a 7.5.2008 M); 1 female (73a 3.11.2008 M); 1 male, 1 female (74a 7.5.2008 M); 1 male, 2 females (100 21.8.2007 M); 1 female (101 22.8.2007 M);1 male, 3 females (119 4.11.2007/29.8.2008 M); 1 male, 1 female (120 04.11.2007 M); 1 male (121b 05.11.2008 M); 1 male (146 29.8.2008 M).

Distribution. *Enithares quadrispinosa* is endemic in the Palawan region including records from the islands of Palawan and Balabac (Lansbury 1968; Zettel *et al.* 2012).

Ecology. Species of *Enithares* inhabit stagnant waters or – more commonly – quiet bays of streams. *E. quadrispinosa* is a lowland species and quite common in Palawan.

Remarks. *Enithares quadrispinosa* is the only species of the genus recorded from Palawan. Its taxonomic status was discussed by Zettel *et al.* (2012).

APHELOCHEIRIDAE (Water Ground Bugs)

Aphelocheirus (s.str.) *palawanensis* Polhemus & Polhemus 1989

Aphelocheirus (s.str.) *palawanensis* Polhemus & Polhemus 1989: 199-200 (orig. descr.); Zettel 1999: 119.

Material. 1 female (63b 21.04.2007 M); 1 male (67 03.4.06 M).

Distribution. This species is endemic on Palawan island.

Ecology. The specimens were collected in gravel bottom substrates of headwater streams in forested areas. This microhabitat is somewhat typical for Aphelocheiridae. Considering the low dispersal abilities of *Aphelocheirus* species, the occurrence of *A. palawanensis* in the temporary Tutong creek is surprising.

Remarks. Nine species and two subspecies of *Aphelocheirus* are known from the Philippines (Zettel 1999, Zettel & Pangantihon 2010).

NEPIDAE (Water Scorpions & Water Needles)

Cercotmetus asiaticus Amyot & Serville 1843

Cercotmetus asiaticus Amyot & Serville 1843: 441 (orig. descr.); Lansbury 1973: 89-92.

Material. 2 N (63a 14.9.2007 M); 1 male, 1 N (63a 16.4.2007 M).

Distribution. *Cercotmetus asiaticus* is known from the southeastern Asian mainland, Sumatra, Java, and Borneo (Lansbury 1973, Chen *et al.* 2005). This is the first record from the Philippines.

Ecology. This water needle lives at the edge of freshwater bodies, usually hidden below plant debris or the undercut of banks.

Remarks. Besides the typical form, the form *C. asiaticus longicollis* Montandon 1909 of uncertain taxonomic status has been described (see Lansbury 1973). The

infraspecific status of the Philippine population, which is restricted to the Greater Palawan region, remains uncertain.

DISCUSSION

The highest diversities (species numbers) in the study area are found in the upper courses of the permanent tributary of the lake (sites 63: 11 species). Comparably high species diversity was found also in the helocrene of Malibongbong Creek (Fig. 6, site 72: 7 species). This result is in line with the species numbers of aquatic Coleoptera recorded in the area (Freitag & Zettel, submitted). It underlines the importance of permanent creeks and helocrenes for the conservation of aquatic macroinvertebrates. Both types of habitats usually depend on closed forest covers; therefore, forest protection will serve also for the protection of the aquatic wildlife.

The most common taxa in the sites sampled are *Limnometra palawanensis* (Fig. 7), *Enithares quadrispinosa* (Fig. 11), *Rhagovelia kawakamii hoberlandti*, and *Metrocoris tenuicornis* (Fig. 9). All but the latter are endemic to Greater Palawan. Overall, one third of the recorded species are Palawan endemics. The rare *Aphelocheirus palawanensis* (Fig. 12) deserves special recognition among these. The plastron-respiring *Aphelocheirus* species require well-oxygenated running waters. Many species of this diverse genus occur allopatrically and endemically on single islands, just as the species in hand.

The distributional pattern of the recorded taxa illustrates well the affiliation of Greater Palawan with the biogeographical Sundaic Region as its easternmost sub-region (Heaney 1985). The region is separated from the eastern Philippine islands by a biogeographic border known as Huxley's Line. Among the taxa with somewhat limited distribution that are not endemic to Palawan alone there are forms known from other Sundaic areas (especially Sabah) rather than Philippine endemic taxa. This is particularly evident in *Rheumatogonus vantoli, Metrocoris tenuicornis, Strongylovelia palawanensis* (see distributional remarks), *Rhagovelia kawakamii hoberlandti,* and *Cercotmetus asiaticus*, a distinct Sundaic species hereby newly recorded for Palawan.

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REFERENCES

Amyot CJB, Serville JGA. 1843. Histoire naturelle des insectes. Hémiptères. *Libraire Encyclopédique de Entomologique de France* 2(4): 239–452.

Andersen NM. 1967. A contribution to the knowledge of Philippine semiaquatic Hemiptera - Heteroptera. *Entomologiske Meddelelser* 35: 260–282.

Andersen NM, 1975. The *Limnogonus* and *Neogerris* of the Old World with Character Analysis and a Reclassification of the Gerrinae (Hemiptera: Gerridae). *Entomologica Scandinavica Supplementum* 7: 1–96.

Andersen NM, 1995. Cladistics, historical biogeography, and a check list of gerrine water striders (Heteroptera, Gerridae). *Steenstrupia* 21: 93–123.

Andersen NM, Yang CM, Zettel H. 2002. Guide to the aquatic Heteroptera of Singapore and Peninsular Malaysia. - 2. Veliidae. *The Raffles Bulletin of Zoology* 50(1): 231-249.

Chen P-P, Nieser N. 1993. A taxonomic revision of the Oriental water strider genus *Metrocoris* Mayr (Hemiptera, Gerridae). Part I. & II. *Steenstrupia* 19: 1-43, 45-82.

Chen P-P, Nieser N. 2002. Taxonomic characters of the male endosomal structure in the genus *Rheumatogonus* Kirkaldy (Hemiptera: Gerridae), with descriptions of four new species from Borneo and Sri Lanka. *Zoologische Mededelingen, Leiden* 76: 371–409.

Chen P-P, Nieser N, Zettel H. 2005. The aquatic and semi-aquatic bugs (Heteroptera: Nepomorpha & Gerromorpha) of Malesia. *Fauna Malesiana Handbooks 5*. Brill, Leiden.

Damgaard J, Buzzetti FM, Mazzucconi SA, Weir TA, Zettel H. 2010. A molecular phylogeny of the pan-tropical pond skater genus *Limnogonus* Stål

1868 (Hemiptera–Heteroptera: Gerromorpha-Gerridae). *Molecular Phylogenetics and Evolution* 57: 669–677.

Davies J, Green J. 1990. A preliminary survey of Lake Manguao, Palawan, the Philippines. *Asian Wetland Bureau Publication* 59: 17–29.

Distant WL. 1909. Oriental Rhynchota Heteroptera. *Annals and Magazine of Natural History* 8(3): 491–507.

Esaki T. 1926. The water-striders of the subfamily Halobatinae in the Hungarian National Museum. *Annales Musei Nationalis Hungarici* 23: 117–164.

Fabricius JC 1775. *Systema entomologiae, sistens insectorum classes, ordines, genera, species, adjectis synonymis, locis, descriptionibus, observationibus*. Korte, Flensburgi et Lipsiae.

Freitag H. 2012. Revision of the Genus *Insulamon* Ng & Takeda, 1992 (Crustacea: Decapoda: Potamidae) with description of four new species. *The Raffles Bulletin of Zoology* 60(1): 37-55.

Freitag H, Jäch M. 2007. Revision of the Palawan and Busuanga species of *Hydraena* (Coleoptera: Hydraenidae) with descriptions of eleven new species and redes-cription of *H. (Hydraenopsis) scabra* d'Orchymont 1923. *Zootaxa* 1431: 1–44.

Freitag H, Pangantihon CV. 2010. Aquatic Coleoptera and Heteroptera of the Lake Naujan National Park, Mindoro Oriental, the Philippines. *Philippine Scientist* 47: 126–173.

Freitag H, Yeo DCJ. 2004. Two new Species of *Parathelphusa* H. Milne Edwards, 1853, from the Philippines (Crustacea: Decapoda: Brachyura: Parathelphusidae). *The Raffles Bulletin of Zoology* 52(1): 227-237.

Freitag H, Zettel H. Aquatic Coleoptera of the Lake Manguao Catchment, Palawan, the Philippines. (submitted: Philippine Scientist)

Gapud VP. 1986. Philippine Water Bugs. In: Gapud VP, Raros LC, editors. *Guide to Philippine Flora and Fauna 8*. Natural Resource Management Center, Los Baños.

Gapud VP. 2003. Two new Philippine *Ochterus* Latreille (Insecta: Hemiptera: Ochteridae) and Checklist of Philippine Species. *Annalen des Naturhistorischen Museums in Wien* 104B: 99–108.

Gapud VP, Zettel H. 1999. The Philippine Water Bug Inventory Project

(PWBIP) and a bibliography for Philippine Nepomorpha, Gerromorpha, and Leptopodomorpha (Insecta: Heteroptera). *Annalen des Naturhistorischen Museums in Wien* 101B: 35–40.

Gapud VP, Zettel H, Yang CM. 2003. The Hydrometridae (Insecta: Heteroptera) of the Philippine Islands. *Annalen des Naturhistorischen Museums in Wien* 104B: 143–162.

Heaney L. 1985. Zoogeographic evidence for middle and late pleistocene land bridges to the Philippines. *Modern Quaternary Research in Southeast Asia* 9: 127–143.

Hungerford HB, Matsuda R. 1961. Some new species of *Rhagovelia* from the Philippines (Veliidae, Heteroptera). *University of Kansas Science Bulletin* 42(4): 257–279.

Lansbury I. 1967. Aquatic Hemiptera-Heteroptera of the Noona Dan Expedition to the Philippines and Bismark Islands. *Entomologiske Meddelelser* 35: 89–98.

Lansbury I. 1968. The *Enithares* (Hemiptera-Heteroptera: Notonectidae) of the Oriental Region. *Pacific Insects* 10: 353–442.

Lansbury I. 1973. A review of the genus *Cercotmetus* Amyot & Serville, 1843 (Hemiptera-Heteroptera: Nepidae). *Tijdschrift voor Entomologie* 116: 83–106.

Lansbury I, Zettel H. 1997. New species and subspecies of the genus *Strongylovelia* Esaki (Insecta: Heteroptera: Veliidae) from Borneo and the Philippines. *Annalen des Naturhistorischen Museums in Wien* 99B: 51–77.

Lethierry L. 1877. Séance du 13 Juin 1877. *Bulletin de la Société Entomologique de France* 1877: 100–102.

Lundblad O. 1933. Zur Kenntnis der aquatilen und semiaquatilen Hemipteren von Sumatra, Java und Bali. *Archiv für Hydrobiologie Supplementum* 12: 1–195, 263–489.

Matsumura S. 1913. *Thousand Insects of Japan Additamenta. Volume 1.* Keiseisha, Tokyo.

Matsumura S. 1915. Übersicht der Wasser-Hemipteren von Japan und Formosa. *Entomological Magazine, Kyoto* 1: 103-119.

Mayr GL. 1865. Diagnosen neuer Hemipteren II. *Verhandlungen der k.k.*

Zoologisch-Botanischen Gesellschaft in Wien 15: 429–446.

Miyamoto S. 1953. Biology of *Microvelia diluta* Distant with description of its brachypterous form and larval stages. *Sieboldia* 1: 113-133.

Nieser N, Chen P-P. 1999. Sixteen new species of *Nepomorpha* (Heteroptera) mainly from Sulawesi (Indonesia). *Tijdschrift voor Entomologie* 142: 77–123.

Polhemus DA. 1998. Two new species of water striders (Heteroptera: Gerridae) from the Philippines. *Proceedings of the Entomological Society Washington* 100(2): 261–268.

Polhemus JT, Lansbury I. 1997. Revision of the genus *Hydrometra* Latreille in Australia, Melanesia, and the Southwest Pacific (Heteroptera: Hydrometridae). *Bishop Museum Occasional Papers* 47: 1–67.

Polhemus DA, Polhemus JT 1989. The Aphelocheirinae of tropical Asia (Heteroptera: Naucoridae). *The Raffles Bulletin of Zoology* 36(2) [1988]: 167-300.

Polhemus JT, Polhemus DA. 1988. Zoogeography, ecology, and systematics of *Rhagovelia* Mayr (Heteroptera: Veliidae) in Borneo, Celebes, and the Moluccas. *Insecta Mundi* 2: 161–230.

Polhemus JT, Polhemus DA. 1995. Revision of the genus *Hydrometra* Latreille in Indochina and the Western Malay Archipelago (Heteroptera: Hydrometridae). *Bishop Museum Occasional Papers* 43: 9–72.

Polhemus JT, Polhemus DA. 2000. The Genus *Mesovelia* Mulsant & Rey in New Guinea (Heteroptera: Mesoveliidae). *Journal of the New York Entomological Society* 108: 205–230.

Polhemus JT, Reisen WK. 1976. Aquatic Hemiptera of the Philippines. *Kalikasan Philippine Journal of Biology* 5: 259–294.

Sariego RS, Benliro IM, Dolorosa RG, Schoppe S, Pagliawan HP. 2003. *Assessment of limnological state of Lake Manguao. Project Terminal Report*. [WPU] Western Philippines University, [PCSDS] Palawan Council for Sustainable Development Staff, Puerto Princesa City.

Scott J. 1874. On a collection of Hemiptera Heteroptera from Japan. Descriptions of various new genera and species. *Annals and Magazine of Natural History* 4: 426–452.

Stål C. 1860. Hemiptera. Species nova descripsit. In: *Kongliga Svenska fregatten Eugenies Resa Omkring Jorden*. Virgin C ed. Norstedt & Söner. Stockholm, 219–298.

Yang CM, Zettel H. 2005. Guide to the aquatic Heteroptera of Singapore and Peninsular Malaysia: 5. Family Hydrometridae. *The Raffles Bulletin of Zoology* 53(1): 79–97.

Yano K, Miyamoto S, Gabriel BP. 1981. Faunal and biological studies on the insects of paddy fields in Asia. IV. aquatic and semiaquatic Heteroptera from the Philippines. *Esakia* 16: 5–32.

Zettel H. 1994a. Ein neuer *Rheumatogonus* Kirkaldy von den Philippinen (Heteroptera: Gerridae). *Entomological Problems* 25(1): 79–82.

Zettel H. 1994b. Revision der philippinischen Arten der Gattung *Rhagovelia* Mayr, 1. Teil (Heteroptera: Veliidae). *Entomological Problems* 25(2): 33–48.

Zettel H. 1996. Revision der philippinischen Arten der Gattung *Rhagovelia*, 3. Teil (Heteroptera: Veliidae). *Entomological Problems* 27(2): 111–140.

Zettel H. 1999. Two new Philippine *Aphelocheirus* Westwood, 1833 (Insecta: Heteroptera: Aphelocheiridae) and a key to the Philippine species. *Annalen des Naturhistorischen Museums in Wien* 101B: 107–121.

Zettel H. 2003. New species, subspecies, and records of *Strongylovelia* Esaki, 1924 (Insecta: Heteroptera: Veliidae) from the Philippines. *Annalen des Naturhistorischen Museums in Wien* 104B: 183–193.

Zettel H. 2004. Neue Wasserläufer (Insecta: Heteroptera: Gerridae) von den Philippinen. *Annalen des Naturhistorischen Museums in Wien* 105B: 361–387.

Zettel H. 2012. Neue Veliidae (Hemiptera: Heteroptera) von den Philippinen. *Zeitschrift der Arbeitsgemeinschaft österreichischer Entomologen* 64: 79-118.

Zettel H, Chen PP. 2000. *Limnometra palawanensis* spec. nov. (Heteroptera: Gerridae), and a synopsis of the Philippine species of *Limnometra*. *Entomologische Berichten, Amsterdam* 60(5): 73–83.

Zettel H, Gapud VP. 1999. A new species group of Oriental *Microvelia* s.l. (Insecta: Heteroptera: Veliidae), with descriptions of three new species. *Annalen des Naturhistorischen Museums in Wien* 101B: 135–146.

Zettel H, Gapud VP. 2003. News on the "Philippine Water Bug Inventory Project", with additions to bibliography. *Annalen des Naturhistorischen Museums in Wien* 104B (2002): 41–43.

Zettel H, Lane DJW, Pangantihon CV, Freitag H. 2012. Notes on Notonectidae (Insecta: Heteroptera) from southeastern Asia, mostly from Brunei and the Philippines. *Acta Entomologica Musei Nationalis Pragae* 52(1): 29–48.

Zettel H, Pangantihon CV. 2010. *Aphelocheirus* (s.str.) *freitagi* nov. sp. from Mindoro Island and additional notes on Philippine Aphelocheiridae (Heteroptera). *Linzer biologische Beiträge* 42: 1353–1362.

Zettel H, Yang CM, Tran AD. 2009: Descriptions of two large water striders of the genus *Limnometra* Mayr, 1865 (Insecta: Heteroptera: Gerridae) from the Philippines and Malaysia. *Annalen des Naturhistorischen Museums in Wien* 110B: 21–31.

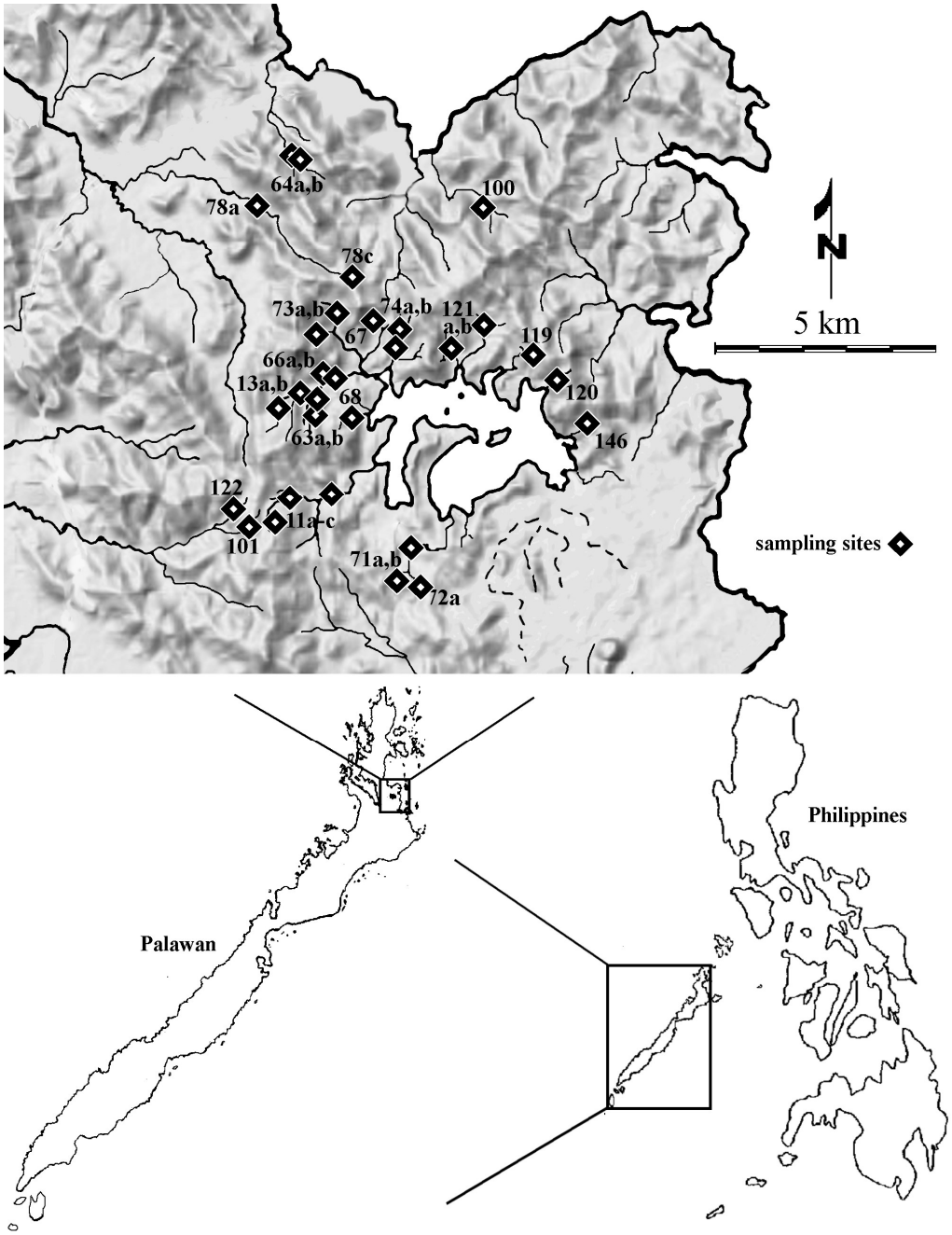
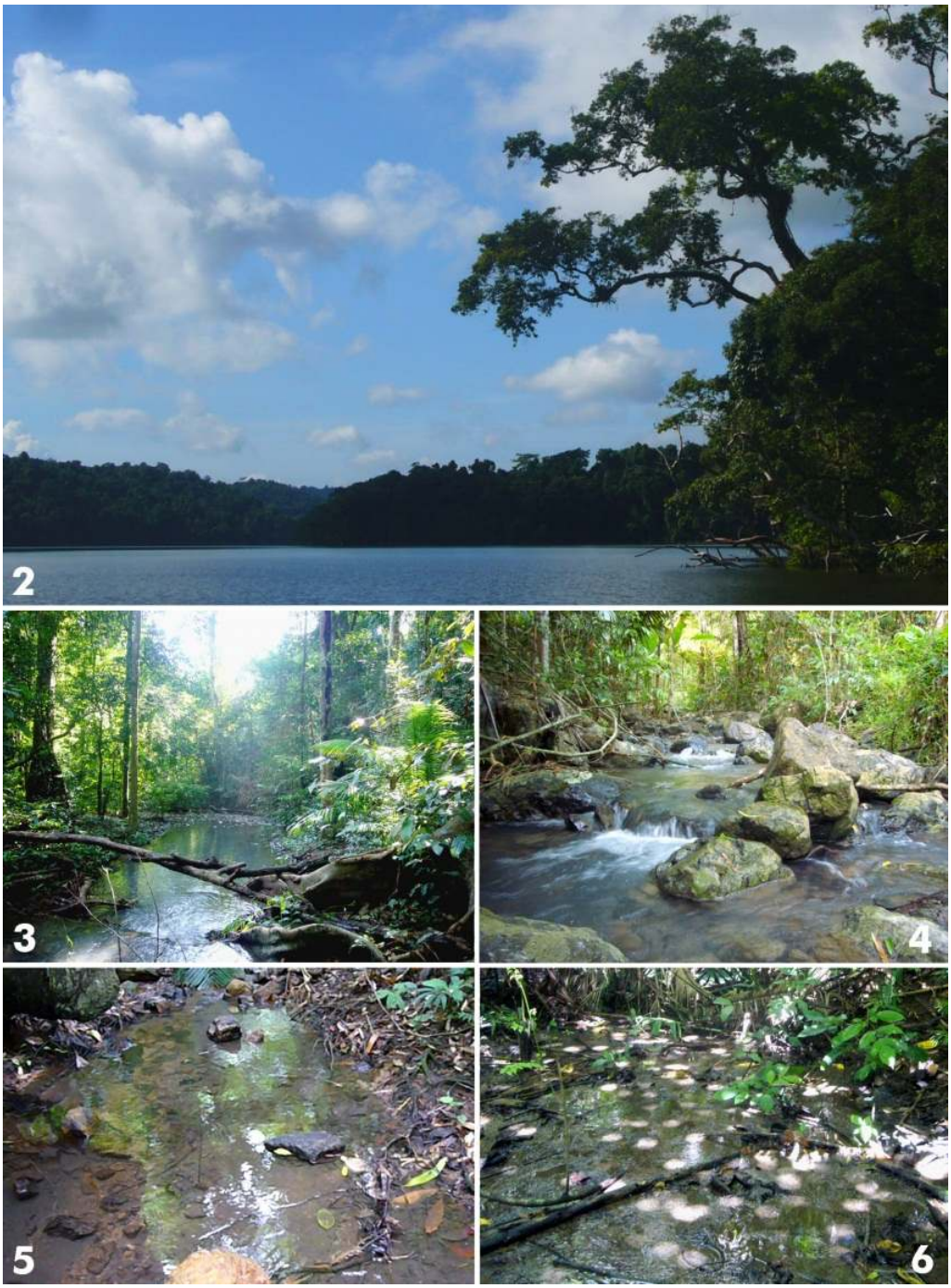
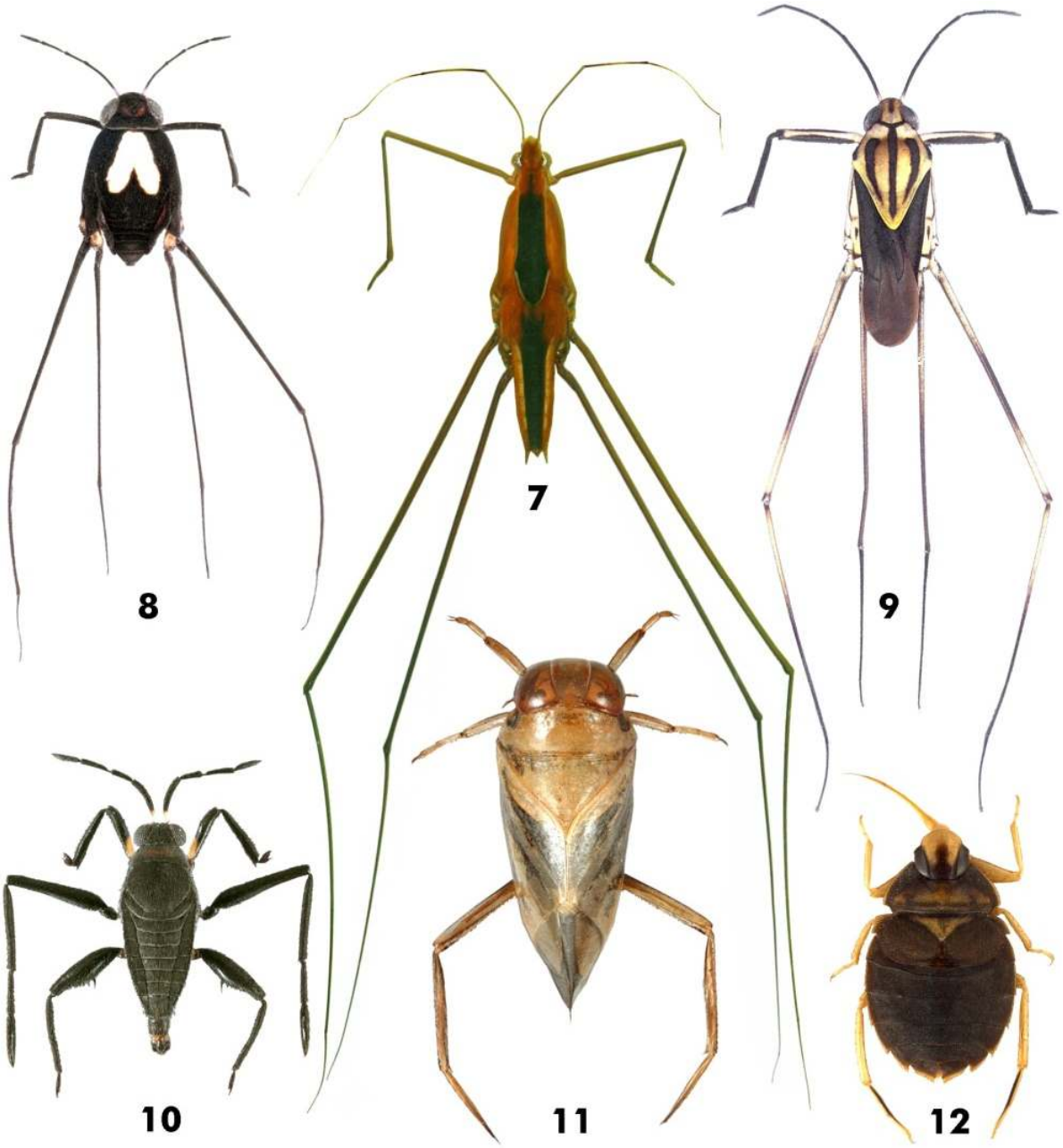


Figure 1. Outline maps of the Philippines, Palawan Island and enlarged physical map of the Lake Manguao area, Taytay, showing locations of sampling as indicated by diamond symbols and site code numbers.



Figures 2–6. Lake Manguao scenery and particular stream microhabitats sampled. 2. Northwestern portion of Lake Manguao near Manguao Stream mouth; 3. Eastern Enolbong Creek with run sections (121a); 4. Eastern Sinangalit Creek with rocky riffle sections (73a); 5. Calm pool zones of the upper Manguao Stream (63a); 6. Helocrene in Malibongbong Forest (72a).



Figures 7–12. Habitus photographs of aquatic Heteroptera of the Lake Manguao catchment (photographs of NMW Hemiptera Image Collection, published with permission). Gerridae: 7. *Limnometra palawanensis* (micropterous male); 8. *Esakia palawanensis* (apterous female); 9. *Metrocoris tenuicornis* (macropterous male). Veliidae: 10. *Rhagovelia palawanensis* (apterous male). 11. Notonectidae: *Enithares quadrispinosa* (female); Aphelocheiridae: 12. *Aphelocheirus palawanensis* (brachypterous female).

Table 1. Hemiptera recorded by sampling sites; M = manual collection; E = emergence trap collection; PH = Philippine; PA = Palawan; E! = Endemic; W = widely distributed in SE Asian or even beyond; undesc. = undescribed; sp. = species (singular); spp. = species (plural); rec. = record; (Sampling sites are described in "Materials and Methods").

Taxa \ Sampling Site Codes	11	13	63	64	67	68	71	72	73	74	78	100	101	119	120	121	122	146	Remarks
Gerridae																			
Limnogonus fossarum	●																		M; W
Limnometra ciliata							●												M; W
Limnometra palawanensis			●			●	●	●	●	●	●		●	●	●	●		●	M, E; PA E!
Neogerris c.f. *parvulus*													●						M; W
Esakia palawanensis	●													●					M; PA E!
Metrocoris tenuicornis			●			●		●	●	●		●	●	●	●			●	M; W
Rheumatogonus vantoli							●	●	●		●								M
Hebridae																			
Hebrus sp.							●												M
Hydrometridae																			
Hydrometra mindorensis			●			●		●	●					●		●			M
Mesoveliiae																			
Mesovelia horvathi			●					●		●								●	M; W
Veliidae																			
Microvelia douglasi				●															M; W
Microvelia leveillei			●																M; W
Microvelia spp.	●		●				●				●								M, E; (undesc. sp.)

Rhagovelia kawakamii hoberlandti			●		●		●	●	●			●	●	●		●	●	M; new status
Rhagovelia c.f. *palawanensis*	●		●							●						●		M; PA E!
Strongylovelia palawanensis	●		●															M; PA E! (see Distribution)
Ochteridae																		
Ochterus sp.	●																	M
Notonectidae																		
Anisops kuroiwae				●														M; W
Enithares quadrispinosa		●	●	●			●	●			●	●	●	●	●		●	M; PA E!
Aphelocheiridae																		
Aphelocheirus palawanensis		●			●													M; PA E!
Nepidae																		
Cercotmetus asiaticus			●															M; new PH rec.